MAR 16 1981 CC: TASK FORCE

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Linde Wells Update
March 1981

Dear Friend.

As you may know, on January 31, 1981, the New York State Assembly Task Force on Toxic Substances released an Interim Report which contained new information concerning the involvement of the federal government in the disposal of radioactively contaminated liquid wastes at the site of what is now the Linde Division of Union Carbide in our Town of Tonawanda In addition, the report documented that plant workers at various Manhattan Project and Atomic Energy Commission operations in the Niagara Frontier Region may have been exposed to excessive levels of radiation during the 1940's.

I wanted to take this opportunity to bring you up to date on the findings contained in that report, my reactions to it, and steps which are now being taken to meet the challenge of these findings.

To better understand the revelations contained in the Assembly report, it is helpful to know some of the background In June of 1942, President Franklin Roosevelt authorized the commencement of atomic energy research and development work which was to include the immediate design and construction of production plants to provide materials necessary for "atomic fission bombs". The project was dubbed the "Manhattan Project" and was formally referred to as the Manhattan Engineering District (MED), of the Army Corps of Engineers To provide the "feed materials" needed for the production of this new atomic weapon, the Manhattan Project began to procure large amounts of uranium bearing ores and convert them through various refinement stages into the feed materials for the manufacture of the atomic bomb.

The Linde Air Products Company in the Town was selected as a refining plant because of the expertise it had acquired from its work in the ceramics business, in which it processed uranium to produce certain substances for the coloring of ceramic glazes.

Linde's contract with the federal government called for it to operate a facility which would refine uranium ore in a series of three consecutive steps. Only the first of those three steps relates directly to the dumping into the wells. In this first step, ordinary uranium ore was refined into uranium oxide (U_3O_8). Additional refinements were made in steps two and three and the product was then shipped to Electrometallurgical Company in Niagara Falls to be further processed through additional steps into uranium metal. The refining of uranium oxide began at Linde in July of 1943 and continued until the supply of low grade uranium ore became unavailable in mid-July of 1946.

The refinement process in "Step One" consisted of adding certain chemicals to the uranium ore to produce the uranium oxide. The waste products of this process consisted of highly caustic alkaline liquids containing primarily sodium sulfate and sodium carbonate, along with traces of uranium oxide which could not be captured The federal government pressed during these years to maintain top priority for the production of uranium metal as it was vital to the war effort and was needed for atomic fuel in the immediate post-war era. The present Linde Division management has emphasized that the Tonawanda Linde site was the only plant in the United States producing uranium oxide for the war effort and any delays could have set back the entire Manhattan Project. Five buildings were used on the Linde site as part of this operation. One building already existed, the other four were built by the federal government

Initially, the radioactively contaminated liquid wastes were discharged into the sanitary sewer system. However, the heavy alkaline nature of the radioactive waste-water made this prohibitive because the alkalinity destroyed bacteria in the sewage treatment plant process which was necessary for its operation When the Town threatened to close off all sewage services to the Linde site, the decision was made by the engineers for the Manhattan Project and Linde to pump the wastes into underground wells. At this time, the engineers expressly rejected the alternative of discharging the radioactive wastes into a storm sewer which emptied into an open ditch, running through a public park, into Two Mile Creek and eventually into the Niagara River. During the ensuing period, until July of 1946, over 37 million gallons of radioactively contaminated liquid chemical wastes were deposited into the wells on the Linde site. In fact, a recent statement from the present management of the Linde Division of Union Carbide indicates that a preliminary review of their records indicate that the actual quantity of the liquid waste disposal into the wells may have exceeded this figure

Significantly, during the period from April 1944 through July of 1946, there were occasions when the wells used for disposal became clogged and at these times the wastes were dumped directly into the storm sewer on the site, which eventually led to Two Mile Creek and the Niagara River. The report indicates that the amount of such discharges probably equalled the amount put into the wells. Initially, only one abandoned well was used at the site However, as production progressed, four additional wells had to be dug on the property for the same purpose.

While it was commonly known before the release of the Assembly report that Linde Air Products had been under contract with the federal government's Manhattan Project to produce materials necessary for the production of the atomic bomb, and while it was known that there has persisted some low levels of surface and building contamination at the site, the use of underground wells for disposal of radioactive liquid wastes and the use of the open storm sewer for the same purpose from April of 1944 through July of 1946 was information totally new to me and to the general public. It obviously created a legitimate sense of concern throughout the community. I was amazed that this information had never come to light given the numerous federal and state-federal interagency reports making reference to the Linde-Manhattan Project operation However, given the fact that much of the information secured by the Assembly Task Force investigators was contained in previously classified documents which were only uncovered using the Federal Freedom of Information Act, it is not that surprising

Despite criticism from some quarters as to the timing of the Task Force report and the manner of its release, it, nevertheless, did serve to bring some new and significant information to light. Knowing what we know now, it is imperative that we find out exactly how safe or unsafe the disposed liquid wastes are to us today. Many of us have lived in this community for decades since the dumping occurred without seeing any apparent widespread patterns of ill health effects, although the attention given to the revelations concerning the wells may now bring forth instances where illness could be linked to radioactivity. There is no question in my mind but that employees who worked at the Linde-Manhattan Project site during the war must have experienced sizeable levels of radioactive exposure However, this historic problem has been known for some time.

The present environmental and health impact of the radioactive liquid wastes disposed of in the underground wells is, at this point, impossible to determine Consequently, it is imperative that the appropriate federal agencies, the Departments of Energy and Defense, begin to drill, bore, and test to determine what, if anything, remains below the Linde site and its environs and to determine what danger, if any, there may be to area residents. Likewise, the path of the liquid wastes disposed of through the open storm sewer to the river should be tested to ensure that no dangers persist there. Because of this unique responsibility of the federal government to take action, due to the fact that its own Manhattan Project was responsible for the disposal methods in question, I have requested the Federal Departments of Energy and Defense to conduct a thorough study of exactly what remains of these wastes.

It is my understanding that the Federal Department of Energy has agreed to begin these tests as soon as the weather breaks this spring Furthermore, I have been advised by Linde that they will undertake limited testing on their own as quickly as possible to make some initial determinations as to the status of the underground wells Additionally, the Federal Department of Energy must, in conjunction with the Federal Department of Health and Human Services, conduct a comprehensive survey of the effects of excessive exposure to radiation on the health of the civilian workers at the Manhattan Project site at Linde and elsewhere in the Niagara Frontier. The present management of the Linde Division of Union Carbide has agreed to cooperate in undertaking an evaluation of all employee health records and to perform an epidemiological study based on those records.

Finally, a few calming notes First, in my layman's view, I do not see how it would have been possible for any of these liquid wastes to have, even in the 1940's, contaminated our Town drinking supplies. The Town of Tonawanda draws its water from the Niagara River well upstream from both the Two Mile Creek and the location of the Linde wells. Additionally, the depth of the Linde wells, while shallow in comparison to many wells used for industrial waste disposal, were, nevertheless, significantly deeper than the water level in the Niagara River. In fact, the Town of Tonawanda engineer has assured all inquirers that there is absolutely no possible way that the Town water supplies could be contaminated due to this method of radioactive waste disposal

Secondly, we must always keep the term "radioactive contamination" in proper perspective. Almost everyone of us is exposed to some level of radioactivity every day of our lives The federal and state governments have been aware for many, many years that some low level radiation persisted at the Linde site, but that with proper precautions, it posed no hazard. In fact, a 1978 Final Report by the U S. Department of Energy had identified low level non-hazardous radioactive contamination on the Linde grounds and in certain Linde site buildings

Additionally, I think it is important to keep in mind exactly what these now much-talked-about liquid radioactive wastes embodied. They were principally sodium sulfate, sodium carbonate, and water They contained five one-hundredths of one percent (.05%) uranium oxide which was only the first product in the many steps of refining uranium ore into uranium metal. Hence, the radioactivity level was really quite slight in the liquid effluents.

While I am deeply concerned at the revelations contained in the Assembly report, I am not now alarmed over any threat of new health dangers due to the existence of the underground wells However, it is imperative that the appropriate technical agencies immediately ascertain what danger, if any, exists. I am in regular touch with both federal and state officials to ensure that proper follow-up is made regarding the Task Force report. My paramount goal will be to ensure the health and safety of the residents of this community and the former Linde-Manhattan Project workers, and to ensure that all the facts are brought into the open

Thank you for taking the time to read this update, as I think it sets things in a proper perspective.

Sincerely yours,

Robin Schimminger

ROBIN L SCHIMMINGER

Levels of U_3O_8 Generally Permitted by State of New York to be Discharged into Public Waters by Users of Radioactive Materials

Technical Supplement to remarks of Joseph R. Clark,
Vice President, Linde Division, Union Carbide Corporation,
delivered to public hearing of Erie County Department of Health
held in Kenmore, New York,
March 11, 1981

We have reported at this hearing that the concentration levels of uranium oxide contained in the liquid waste injected by the Linde Tonawanda Ceramics Plant into on-site wells in 1944-1946 during the performance of work for the U.S. Government on the Manhattan Project did not exceed the limits imposed today by the State of New York on the discharge of such radioactive material into public waters. This supplement provides the technical basis for that statement.

The currently effective concentration limit established by the State of New York for the discharge into public waters of liquid waste containing natural uranium is set forth in Paragraph 16.7(b)(1) of the State Sanitary Code and in Appendix 16-A, Table 4, Schedule II at the end of Chapter I of that Code. The limit is stated as 2×10^{-5} microcuries per milliliter ($\mu c/ml$) averaged over a period of one year. (There was, of course, no such limit in effect in 1944-46.) To convert this concentration to the more familiar concentration unit of parts per million, it is necessary to know the relationship between the radioactivity content and the weight of a given amount of natural uranium and to know the fraction of uranium contained in a given amount of the uranium oxide involved, U_3O_8.

The specific activity of natural uranium (the form of uranium that was contained in the liquid waste that was disposed of by the Ceramics Plant in 1944-46) is given in Title 10 of the Code of Federal Regulations, Part 20, Appendix B (in footnote 4 found on page 218 of the January 1, 1980 edition) as 6.77×10^{-5} curies per gram of natural uranium, which is equivalent to 0.677 microcuries per gram ($\mu c/gm$). The relative atomic weights of the constituents of U_3O_8 produced from natural uranium are 238 and 16 for the uranium and oxygen, respectively. Since each molecule of this form of uranium oxide contains three atoms of uranium and eight atoms of oxygen, its molecular weight is 842 and the fraction of each molecule comprised of uranium is .848. The conversion formula is then given by

$$U_3O_8 \text{ Concentration Limit} = 2 \times 10^{-5}\ \mu c/ml$$

$$= \frac{2 \times 10^{-5}\ \mu c/ml}{.677\ \mu c/gm \times .848}$$

$$= 3.48 \times 10^{-5}\ gm/ml$$

$$= 34.8 \times 10^{-5}\ gm/ml$$

$$= 34.8 \text{ parts per million (ppm)}$$

The available Ceramics Plant production data for the 113 weeks involved indicates that the average uranium oxide concentration of the liquid waste discharged into the disposal wells at Tonawanda in 1944-46 did not exceed 34.8 ppm over any one-year (i.e., consecutive 52-week) period.

Department of Energy
Washington, D.C. 20545

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TO. Vince Hayes, Linde Div., UCC N.Y. 716-879-2265
Name / Location / Telephone Nr

FROM. Robert Barber, DOE, WASH. D.C. 301-353-5028
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3/9/81 LINDE DIVISION, UCC, N.Y. GROUND-WATER SAMPLE RESULTS

SAMPLE 1 - LINDE GAS WELL NEAR BUILDING 77
2 - DUNLOP WELL
3 - LINDE WELL C AT 84.5'
4 - LINDE WELL C AT 89.'
5 LINDE WELL C AT 114.8
6 LINDE WELL C AT 150'

ALL SAMPLES MARKED "A" (1A, 2A, 3A, 4A, 5A, 6A) ARE SUSPENDED SOLIDS
ALL SAMPLES MARKED "B" (1B, 2B, 3B, 4B, 5B, 6B) ARE DISSOLVED SOLIDS
CESIUM 137, THORIUM 232 CHAIN, AND RADIUM 226 DONE BY GAMMA SPECTROSCOPY
URANIUM DONE BY FLUOROMETRIC ANALYSIS. (URANIUM IS ASSUMED TO BE NATURAL)

LIMITS FROM 0524 'STANDARDS FOR RADIATION PROTECTION'
CESIUM - ALL LEVELS TOO LOW TO WORRY ABOUT
THORIUM 232 CHAIN - 1 pCi/ml (soluble), 10 pCi/ml (insoluble),
RADIUM 226 .03 pCi/ml (soluble) 30 pCi/ml (insoluble)
URANIUM (NATURAL) 20 pCi/ml (soluble) 20 pCi/ml (insoluble)

1A	CESIUM 137	.03 pCi/g	
	THORIUM 232	< .4	
	RADIUM 226	.94 ± .07	.013 pCi/ml
	NATURAL URANIUM	107.66	1.56

1B	^{137}Cs	.03 ± .12 pCi/g	
	^{232}Th (CHAIN)	.18 ± .05	.0126 pCi/ml
	^{226}Ra	.24 ± .04	.017
	U	1.118	.078

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4B	^{137}Cs	.1 ± .03 pCi/g	
	^{232}Th	<.06	
	^{226}Ra	<.02	<.0017 pCi/ml
	U	.517	<.0045
5A	^{137}Cs	<.03	
	^{232}Th	.61 ± .06	.006
	^{226}Ra	.58 ± .06	.006
	U	6.08	.064
5B	^{137}Cs	<.03	
	^{232}Th	.09 ± .04	.0001
	^{226}Ra	.04 ± .02	.0005
	U	.342	.0043
6A	^{137}Cs	<.03	
	^{232}Th	<.06	
	^{226}Ra	.34 ± .06	.0003
	U	12.234	.0113
6B	^{137}Cs	<.03	
	^{232}Th	<.06	
	^{226}Ra	<.02	<.0002
	U	.286	.0036

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2A	^{137}Cs	<.13 pCi/g	
	^{232}Th	<.06	
	^{226}Ra	15 ± 8	.0003 pCi/ml
	(no U)		
2B	^{137}Cs	<.13 pCi/g	
	^{232}Th	<.06	
	^{226}Ra	<.12	
	(no U)		
3A	^{137}Cs	<.13 pCi/g	
	^{232}Th	<.62 ± .06	.027 pCi/ml
	^{226}Ra	.8 ± .07	.035
	U	5.94	.26
3B	^{137}Cs	.32 ± .06 pCi/g	
	^{232}Th	<.06	
	^{226}Ra	<.12	.000084 pCi/ml
	U	1.468	.006
4A	^{137}Cs	<.13 pCi/g	
	^{232}Th	.36 ± .07	.012 pCi/ml
	^{226}Ra	.43 ± .04	.014
	U	2.3	.076

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Washington D.C. 20545

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TO VINCE HAYES (Name) LUDE DIV. NY (Location) 716-879-226 (Telephone No)

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SAMPLE		pCi/g	ppm	pCi/ml
4B	^{137}Cs	.1 ± .03		
	^{232}Th	< .06		
	^{226}Ra	< .02	< .02 × 10^{-6}	< .0002[illegible]
	U	.517	.74	.0045
5A	^{137}Cs	< .03		
	^{232}Th	.61 ± .06		.006
	^{226}Ra	.58 ± .06	.59 × 10^{-6}	.006
	U	6.08	8.7	.064
5B	^{137}Cs	< .03		
	^{232}Th	.09 ± .04		.0001
	^{226}Ra	.04 ± .02	.04 × 10^{-6}	.0005
	U	.342	.49	.0043
6A	^{137}Cs	< .03		
	^{232}Th	< .06		
	^{226}Ra	.34 ± .06	.35 × 10^{-6}	.0003
	U	12.234	17.5	.0113
6B	^{137}Cs	< .03		
	^{232}Th	< .06		
	^{226}Ra	< .02	.02 × 10^{-6}	.0002
	U	.286	.41	.0036

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Sample		pCi/g	ppm	pCi/ml	ppm
1A	Cesium 137	.03			
	Thorium 232	< .06			
	Radium 226	.44 ± .07	$.46 \times 10^{-6}$	.013	$.013 \times 10^{-6}$
	Natural Uranium	107.66	154.	1.56	2.3
1B	^{137}Cs	.03 ± 2			
	^{232}Th	.18 ± .05		.0126	
	^{226}Ra	.24 ± .04	$.24 \times 10^{-6}$	.017	$.017 \times 10^{-6}$
	U	1.118	1.62	.078	.115
2A	^{137}Cs	< .03			
	^{232}Th	< .06			
	^{226}Ra	15 ± 8	$15\ 3 \times 10^{-6}$	.0003	$.3 \times 10^{-9}$
	U	< 14	< 2.0	< .00003	< .00004
2B	^{137}Cs	< .03			
	^{232}Th	< .06			
	^{226}Ra	< .02	$.02 \times 10^{-6}$		
	U	< .14	< .2	< .0002	< .0003
3A	^{137}Cs	< .03			
	^{232}Th	< .62 ± .06		.027	
	^{226}Ra	.8 ± .07	$.82 \times 10^{-6}$	.035	$.036 \times 10^{-6}$
	U	5.44	8.5	.26	.38
3B	^{137}Cs	.32 ± .06			
	^{232}Th	< .06			
	^{226}Ra	< .02	$.02 \times 10^{-6}$	.000084	$.084 \times 10^{-9}$
	U	1.468	2.1	.066	.009
4A	^{137}Cs	< .3			
	^{232}Th	[illegible]		[illegible]	
	^{226}Ra	.43 ± .04	$.44 \times 10^{-6}$	.014	$.014 \times 10^{-6}$
	U	[illegible]	[illegible]	[illegible]	[illegible]

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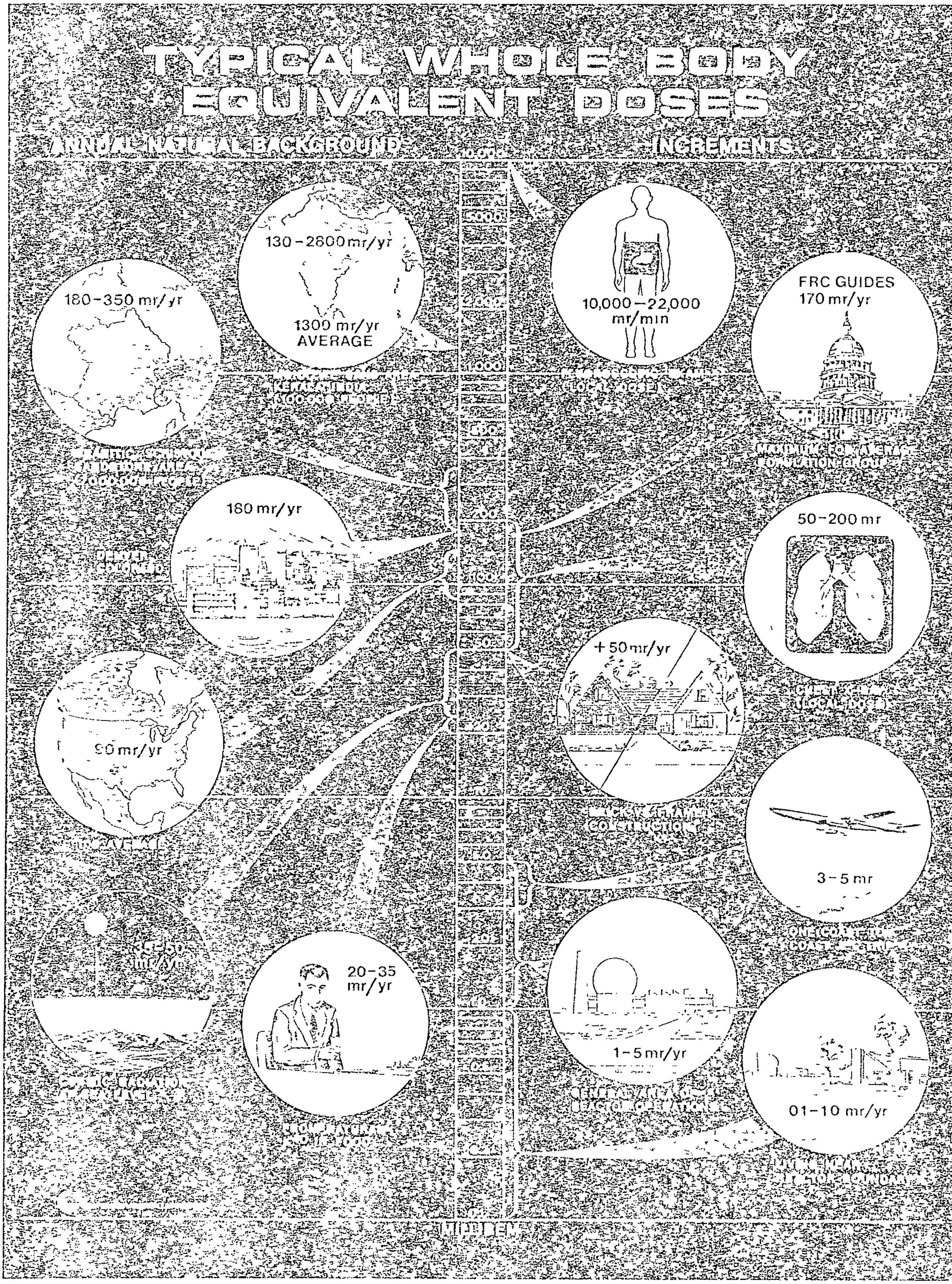
TYPICAL WHOLE BODY EQUIVALENT DOSES
ANNUAL NATURAL BACKGROUND
INCREMENTS
130-2800 mr/yr
1300 mr/yr AVERAGE
180-350 mr/yr
10,000-22,000 mr/min
FRC GUIDES 170 mr/yr
180 mr/yr
50-200 mr
+50 mr/yr
90 mr/yr
3-5 mr
20-35 mr/yr
1-5 mr/yr
01-10 mr/yr
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ANALYSIS OF SOIL - Preliminary Analysis of Radionuclide Concentration in Subsurface Soils and Formations Near Former Inspection Wells of Linde Air Products, Tonowanda, NY

3/10/81

Monitoring Well	Depth	RADIONUCLIDE CONCENTRATION pci/gm				1 pci/gm ≅ 6 [illegible]	REMARKS
		Ra-226 (Bi214)	U-238 (a)	U-235 (b)	K-40	Th 232 (Ac 228)	
"C"	150 ft.	.14 ± .12	< 4.4	< .20	6.5 ± 1.2	.28 ± .12	
"C"	140 ft.	.60 ± .12	< 4.4	< .20	22.3 ± 2.2	.36 ± .20	
"C"	130 ft.	.72 ± .12	< 4.4	< .20	23.1 ± 2.1	.65 ± .21	
"C"	120 ft.	.88 ± .16	< 4.4	< .20	28.9 ± 2.7	.66 ± .31	
"C"	110 ft.	.87 ± .15	< 4.4	< .20	24.3 ± 2.5	.83 ± .26	
"C"	100 ft.	.51 ± .12	< 4.4	< .20	11.3 ± 1.7	.28 ± .24	
"C"	89 ft.	.30 ± .038	< 4.4	< .20	10.1 ± .51	.30 ± .07	
"C"	80 ft.	.35 ± .120	< 4.4	< .20	10.7 ± 1.7	.06 ± .14	
"C"	70 ft	1.1 ± .20	< 4.4	< .20	26.9 ± 2.9	1.5 ± .41	
"C"	60 ft.	.84 ± .16	< 4.4	< .20	19.9 ± 2.3	57 ± .32	
"C"	50 ft.	.91 ± .20	< 4.4	< .20	21.3 ± 3.1	.82 ± .35	
"C"	40 ft.	.90 ± .26	< 4.4	< .20	< .39	1.54 ± .50	
"C"	30 ft.	.72 ± .16	< 4.4	< .20	20.9 ± 2.4	1.0 ± .24	
"C"	20 ft.	1.2 ± .08	3.8 ± .66	.17 ± .03	18.6 ± 9.3	.87 ± .13	
"C"	10 ft.	1.0 ± .22	22.1 ± 1.33	1.0 ± .06	19.4 ± 2.7	1.1 ± .32	
#2,#3	70 ft	.76 ± .18	< 4.4	< .20	27 ± 2.9	.95 ± .35	
#2,#3	60 ft.	.98 ± .19	< 4.4	< .20	25.2 ± 2.6	.92 ± .36	
#2,#3	50 ft	.89 ± .07	26.5 ± .88	1.2 ± .04	.11 ± .02	1.24 ± .14	
#2,#3	40 ft.	.94 ± .16	< 4.4	< .20	.83 ± .11	1.2 ± .30	

UCCNHT0000351

ANALYSIS OF SOIL - Preliminary Analysis of Radionuclide Concentration in Subsurface Soils and Formations Near Former Inspection Wells of Linde Air Products, Tonowanda, NY 3/10/81

		RADIONUCLIDE CONCENTRATION pci/gm					REMARKS
toring ells	Depth	Ra-226 (Bi214)	U-238 (a)	U-235 (b)	K-40	Th 232 (Ac228)	
?.#2	30 ft.	.85 ± .18	< 4.4	<.20	24.7 ± 2.7	1.02 ± .28	
?,#3	20 ft.	.06 ± .04	9.9 ± 3.1	.45 ± .14	17.3 ± 2.0	.27 ± .20	
?,#3	10 ft.	1.14 ± .07	2.65 ± .44	.12 ± .02	17.4 ± .79	.90 ± .11	

a) Based on Uranium-235 concentration and assuming a natural uranium ratio.

b) 186 Kev corrected for Ra226

c)	MDA	.30		.20	.39	.05	
d)	x MDA	.10		.069	.13	.017	

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